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Petrographic and petrophysical comparison of Cardium light oil reservoirs between east and west Pembina Field

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Summary

Pembina Field is located in west-central Alberta on the eastern edge of the Western Canadian Sedimentary Basin and is one of the largest conventional producing oil fields in Canada. The field was discovered in 1953 and exploited by vertical wells, along with water injection wells and horizontal wells. Since 2008, multistage hydraulic fractured horizontal drilling programs have successfully renewed this legacy play with increased production from tighter strata within and along the edges of Pembina field.

The conventional sandstone and conglomerate reservoirs have been tapped into and therefore, unconventional techniques including the drilling of horizontal wells and multi-stage fracture completion technology are now being implemented within the muddier sediments of the Cardium Formation. As a result, interest in the lower permeability sediments of the formation has been regenerated due to these new methods that enable the unlocking of oil reserves that were otherwise not producible without horizontal drilling and hydraulic fracturing technology.

In this study, petrographic and petrophysical techniques are combined to characterize reservoirs in both east and west Pembina field. Core observations, thin section point counts and x-ray diffraction data are used to identify and quantify mineralogical composition, while routine core analysis, profile permeability and mercury injection data are used to identify and quantify porosity and permeability relationships.

The integration of these data sets shows that although the primary mineralogy is very similar in each area, secondary diagenetic mineralogy varies and affects porosity and permeability, resulting in two distinct reservoirs. Results confirm that integrating various data sets can aid in resolving reservoir heterogeneity that can be otherwise undetected using traditional methods alone. The methodology from this study can be upscaled and applied to the Cardium tight oil play, or to similar reservoirs, such as the Viking Formation and other siliciclastic units.